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NEBC MEETING NEWS

November 1999. Bruce A. Sorrie, former botanist for the Massachusetts Natural Heritage and Endangered Species Program and now a botanical consultant in the southeastern United States, spoke on the topic, "Diversity and endemism in the Coastal Plain Flora." Sorrie defined the coastal plain as the exposed portion of the continental shelf that extends from Cape Cod, Massachusetts to a portion of eastern Mexico and northward into the area known as the Mississippi embayment. It is an area composed of Cretaceous age and younger deposits, which are mostly oceanic but augmented by materials derived from the older adjacent physiographic provinces. Its inland boundary is defined by "the Fall Line," where one encounters rocks of Paleozoic age. "The coastal plain occupies about 8% of the North American landmass," he said. The geologic boundaries of the coastal plain match the boundaries of what Sorrie considers to be the Coastal Plain Floristic Province. To put the coastal plain flora in perspective, Sorrie compared it to the Appalachian Floristic Province, a much older area geologically, and one regarded as a refuge for plants during periods of widespread inland seas and global climate change. While it has long been considered a major center of evolution from which most eastern North American species evolved, the Appalachian Floristic Province, Sorrie points out, has only seven endemic genera: *Cymophyllus, Galax, Rugelia, Diamorpha, Amphianthus, Jamesianthus, Nestronia,* and *Rugelia.* Many other genera often thought of as endemic to the Appalachian Province, e.g., *Astilbe, Disporum, Jeffersonia,* and *Menziesia,* are actually Arcto-Tertiary disjuncts with species also occurring in eastern Asia or elsewhere. Sorrie also mentioned a number of genera centered in the Appalachians which have spread well beyond the borders of the Province, e.g., *Chamaelirium, Clintonia, Epigaea,* and *Liriodendron.* He estimated that there might be about 200–300 endemic species in the Province, but he has not seen a figure on this.

Using a quote from the late Alwyn Gentry, Sorrie explained that the southeastern coastal plain is "a conspicuous but often overlooked center of endemism in temperate North America." Gentry said, "It is remarkable that Florida, only 152,000 km^2 and with virtually no topographic relief, should rank second only to California in number of endemic species; it is even more re-

markable when we consider that the endemic plant species are concentrated in northern and central Florida, not in the subtropical southern part." According to Sorrie, there are 215 species wholly confined to Florida, and another hundred or so that extend but a short distance from its borders into Alabama and/or Georgia. For the coastal plain as a whole, there are two endemic plant families, 48 endemic genera, 35 of which are monotypic, and about 1400 endemic species, he said. Endemism occurs in many other coastal plain plant genera, 98 of which have five or more endemic species, he added. He felt that 60 million years of partial exposure of the coastal plain had allowed for considerable *in situ* plant colonization and evolution of new taxa. Sorrie's slides illustrated many of the endemic genera. Among them were: *Balduina, Ceratiola, Dicerandra, Franklinia, Harperocallis, Lachnanthes, Macranthera, Pinckneya, Pyxidanthera, Schwalbea, Sclerolepis, Stokesia, Warea,* and *Zenobia.*

Sorrie joked about the seemingly monotonous, pine-dominated landscape of the coastal plain. He quoted Roland Harper, a pioneering botanist in the southeastern coastal plain, who described a 700-mile train trip from Augusta, Georgia to Richmond, Virginia, where he did "not remember seeing any rocks, bluffs, escarpments, hills, ravines, gullies, springs, or hammocks, or passing through any railroad cuts deep enough to obstruct the view." Sorrie commented that some topograpic maps for eastern North Carolina even lack topographic contour lines! Why then, he rhetorically asked, does the coastal plain support such botanical diversity? Answering his own question, he gave seven possible reasons: (1) subtle shifts in soil composition and chemistry with eight of ten global soil orders represented; (2) subtle shifts in soil moisture; (3) subtle elevational differences that have profound effects on plant communities; (4) high humidity and percentage of sunshine; (5) the highest frequency of lightning strikes in the U.S., which results in many fire-adapted communities with high herb diversity; (6) up to 60 million years of vegetational history that has provided, at least, some localized refuges for temperate species during times of maximum glacial advance; and (7) the derivation of the flora from multiple source areas, including the tropics, subtropics, prairies and deserts, as well as from *in situ* speciation. A summary of ten different geographic patterns of floristic endemism in the coastal plain, followed by some questions from the audience, ended the meeting.

December 1999. Dr. Leila Shultz, Research Associate Professor at Utah State University, presented a lecture entitled "Breaking new ground in floristics: Using geographic information systems to predict species distributions in western North America." For the neophytes on Utah geography and flora, she started by describing 4–6 floristic provinces of Utah, the exact number depending on one's interpretation. The Colorado Plateaus define the southeastern portion of the state while the southwestern corner is considered an eastern extension of the Mojave Desert floristic province. A western fifth of the state consists of the Great Basin (formerly occupied by the pleistocene Lake Bonneville) and 35 associated mountain ranges including the calcareous Wasatch Mountains that form the Basin's eastern border. The northwestern corner has mountains of igneous origin and a flora influenced by migrations from the Pacific Northwest. This leaves one or more provinces in the east that include the Uinta Mountains, with floristic affinities to the Rocky Mountains; the Uinta Basin, considered by some to be part of the Colorado Plateaus; and the La Sal Mountains along the border with Colorado. The Utah flora includes 2602 native and 682 introduced species, and these numbers are increasing due to new discoveries and introductions. Between 1974 and 1994, 88 new species were described from Utah, a number of them by Shultz herself. Also, newly naturalized introductions have contributed about 100 new taxa to the flora since 1987, she said. It is a state where 10–15% of the flora is considered endemic and about 250 species have been proposed for federal listing.

Dr. Shultz described the collaborative efforts between herself, Martha Aiken, and other researchers at Utah State University to develop and test a geographic information system (GIS) for floristic data that would have the capability of predicting new locations for the state's rare plants. A first step toward this end was to create a rare species specimen database from which geographic coordinates could be extracted. A rare species appendix to the *Atlas of Vascular Plants of Utah* published in 1988 by Albee, Shultz, and Goodrich helped with this effort. Herbarium specimens that could be mapped at a 10 × 10 km scale or finer were selected and digitized, so that each mapped species represented a data layer in the GIS. The predictive modeling research was largely that of Aiken who completed a Master's thesis entitled "Predictive modeling of rare plant habitat in the eastern Great

Basin," a project funded by the Bureau of Land Management and the Hill Air Force Base. A field key was developed from environmental attributes and associated species data collected at 467 site plots. Approximately 20% were presence plots for rare species. Four rare plant species were selected for their representation of different kinds of habitats: *Sphaeralcea caespitosa* (valley & foothill sites), *Penstemon concinnus* (pinyon-juniper woodland), *Primula domensis* (faces of dolomite cliffs), and *Jamesia tetrapetala* (granite canyons). New data layers with site-specific data were then added to the baseline information provided by the coarse grid-distributions provided by the Atlas. Additional data for the GIS models came from four existing geographic databases: one elevational, both state and national soil databases, and a surficial geology database. Probability of occurrence maps were then developed from the GIS data containing 13 environmental variables encompassing slope, elevation, aspect, soil, and geologic data.

The predictive model used a tree-classification system to sort data using binary recursive partitioning. The attribute data for each variable were examined sequentially to identify the optimal partition resulting in the most homogeneity within classes and the most heterogeneity between classes. The procedure was repeated for each branch of the key. The result was a dichotomous key that was then incorporated into a computer program for extrapolation of the classification over large areas. The dichotomous key produced in S-Plus was written as a series of conditional statements for GRID, such that each variable in the model was represented by a unique grid coverage. GRID is a cell-based geoprocessing software that is integrated with ARC/INFO. As GRID reads the conditional statement, each grid cell is analyzed and simultaneously a new grid is generated in which each cell reflects the predictions of the terminal leaves of the conditional statement. The new grid is then converted to polygon coverage and the predictions are mapped using ARCPLOT.

Models were evaluated for total percentage of correct predictions and analyzed using two statistical tests for utility and bias. Both field-based and GIS-based models performed well for all four species of plants tested. For the GIS, based on 12 different models, mean accuracy was 97% for all predictions; for the Field Key, based on 16 models, the mean for correct predictions exceeded 95%. The models with the highest utility and lowest bias

used elevation and aspect in predicting distributions. Over-prediction occurred for all species but was considered less of a problem than under-prediction.

The presentation included habitat pictures for a number of rare species from the vast remote areas of Utah. Most of the species shown were discovered and described in the 1970s–80s. Although the rate of new discoveries has declined, a respectable number of new finds occurred in the 1990s, demonstrating a need for continued botanical exploration in remote areas of the intermountain west. Shultz emphasized the importance of using separate fields for spatially explicit data (e.g., latitude and longitude) in herbarium databases, thus providing a means for transporting floristic data to geographic information systems. She encouraged the employment of different spatial scales depending on the data source, i.e., 10 km grids for the generalized localities provided by most herbarium collections and 1 km grids for records with latitude and longitude given in seconds. Databases developed from site-intensive studies such as those used in the Utah predictive model can serve the dual role of providing floristic information for herbarium vouchers and ecological data for mathematical models that investigate the relationship of plant distributions to climate and ecology.

January 2000. The first program of the year 2000 was titled "First Friday Foray into Fantastic Flora," better known as the annual "show and tell," where members are invited to make short presentations that typically involve showing and narrating a small number of slide images. As exemplified by first presenter, Donald Lubin, however, slides are not a necessary prerequisite. Don explained that he had prepared 62 laminated fronds of fern taxa and would have them available for examination after the meeting. He also spoke of fern exploration with Ray Abair that resulted in three wood fern hybrid taxa being discovered in the Blue Hills south of Boston and the verification of 39 pteridophyte taxa at Wachusett Mountain in Worcester County, including eight that had not been reported previously. Lisa Standley started the slides with images from the Okavango Delta in Botswana. We were shown a relatively flat landscape with enormous wetlands that resemble, according to Lisa, marshes of Manitoba. Here she saw many familiar genera such as *Typha, Phragmites, Nymphaea, Eleocharis,* and *Scirpus,* but mixed with them stems of *Papyrus.*

Several trees from upland habitat were featured including the sausage tree, *Kigelia* (with bat-pollinated orange flowers and large, sausage-shaped fruits), and baobabs, all large trees up to 10–12 ft. in diameter at their bases. Not seeing any immature baobabs, Lisa expressed concern about whether or not they were reproducing. Close-ups of African large game, including one showing a group of side-by-side lionesses in crouched position lapping water, ended the brief glimpse of Africa.

Nancy Eyster-Smith brought us back to the U.S. for a look at vegetation management activities witnessed in national parks on a family trip across country this past summer. At Glacier National Park, she saw propagated native species being planted along walkways as part of a revegetation project, and new metal boardwalks that had been installed to prevent further trampling near Logan Pass. She also observed sites where exotic taxa had been spot-sprayed with herbicides. At Little Bighorn Battlefield National Memorial, people were seen pulling an invasive species of *Hypericum* by hand. Jumping to the Caribbean, Richard Falcona illustrated some arid landscapes and scenic views from the island of St. John in the U.S. Virgin Islands. Plant taxa shown were turk's cap cactus, *Melocactus intortus,* and century plant, *Agave missionum,* both native to the island. Paul Somers illustrated a few nonindigenous species encountered on a trip to the islands of Nevis and St. Kitts. Examples shown were *Momordica charantia* (Cucurbitaceae) and *Calotropis procera* (Asclepiadaceae), both indigenous to the Old World tropics, and cashew trees, *Anacardium occidentale,* a native of northern South America. Paul also showed a few shots of wetland plants taken in Massachusetts, including *Utricularia cornuta* and *U. inflata* from Plymouth County, *Potamogeton ogdenii* from Berkshire County, and a possible new record of *Lycopodiella alopecuroides* from northern Worcester County. Sticking with the Massachusetts theme, Pam Weatherbee illustrated some habitats and plants encountered during a biological survey of the Hop Brook Wildlife Management Area in southern Berkshire County. Despite a long history of land utilization, Pam reported finding some relatively natural wetlands with species such as *Iris versicolor, Galium palustre, Salix candida,* and *Salix serissima*; forest communities containing an interesting association of *Quercus bicolor* and *Carpinus caroliniana*; and even a couple of rare plant species. Also catching Pam's eye during the survey was a beautiful Baltimore checkerspot, a

butterfly species thought to be switching from *Chelone* to *Plantago* as a food plant.

Andy Finton then took us across the Berkshires to the Hudson River Valley of New York for a presentation on plant community inventory work recently completed there by himself and colleagues at the New York Natural Heritage Program. We learned about remnant serpentine barrens on Staten Island; oak-dominated forests with heath understories in the river valley and rocky summit communities; and beech-maple and spruce-dominated old growth forests in the Catskills, where one conifer swamp yielded a black gum aged at 485 yrs. Other communities highlighted were calcareous cliff communities with calciphile ferns in Albany and Greene Counties and bog, sedge meadow, and spruce flat communities of the Rensselaer Plateau.

The closing presentation was by George Newman who visually transported us to the Gaspé Peninsula for a preview of sites to be visited and things to do during the NEBC summer field trip in July, 2000. George emphasized the extensive serpentine barrens above timberline on Mont-Albert and the many calciphiles that could be found in sea cliffs around Mont Ste. Pierre. At Forillon National Park, options of boating to watch sea lions and seals or botanizing the talus slopes of Cap-Bon-Ami were offered as enticements. In the Percé vicinity, exploring calcareous conglomerate formations of Mont Ste-Anne, sea cliffs occupied by gannets and puffins on Ile Bonaventure, or limestone river beds of Grand Rivière were presented as interesting options.

—PAUL SOMERS, Recording Secretary.